

DOI: 10.34854/ICPAF.51.2024.1.1.024

ELECTRON CYCLOTRON RESONANCE AND ITS FEATURES AT THE TOKAMAK T-15MD INSTALLATION (TO THE EXPERIMENTS ON PREIONIZATION AT THE SECOND HARMONIC OF THE ECR) ^{*)}

Borschegovskiy A.A.

*National Research Centre "Kurchatov Institute", Moscow, Russia,
Borschegovskiy_AA@nrcki.ru*

In the spring and summer period, the first series of experiments on the preionization of the working gas (H₂) at the second harmonic of the ECR was performed at the T-15MD installation. Such kind of experiments were carried out on T-7 and T10 [1, 2] tokamaks in previous time.

Focused microwave radiation at a frequency of 82.6 GHz with vertical linear polarization of the wave vector \vec{E} was introduced at a toroidal angle $\psi = 18^0$ from the low magnetic field side. The values of toroidal field induction on the axis of the chamber were $B_0 = 1.0\text{--}1.1$ T. The zone of "cold" resonance at this frequency was located on the side of a strong magnetic field. The maximum power density in the cross section of the microwave beam at $\rho_0 = 2.7$ cm in this area was $p = 38$ kW/cm², with the full value of the input power $P = 0.87$ MW. The amplitude of the wave electric field vector \vec{E} reached 3.8 kV/cm. With these parameters and the presence of a vertical magnetic field, an ECR breakdown was successfully performed, which was recorded by high-speed cameras. The plasma discharge was maintained throughout the entire gyrotron pulse. The energy of the electrons in the Electron-Cyclotron resonance zone is analyzed when the Doppler synchronism condition is met in the real geometry of the microwave radiation input at the Tokamak T-15MD installation. The basis for the research was the fact that at the stationary stage of the discharge, in the absence of electric fields of the tokamak in the internal volume of the vacuum chamber, high-energy X-ray quanta in the range of 2–3 MeV were recorded [3]. In this paper, the possibility of the formation of electrons with such energies is discussed.

The work was carried out under the State Assignment of NRC «Kurchatov institute».

References

- [1] Alikaev V.V., Borschegovskii A.A., Chist'akov V.V., et al. «Experiments on Current Drive and Plasma Heating by LH and EC Waves in the T-7 Tokamak» // Plasma Physics and Controlled Nuclear Fusion Research. Vienna: IAEA, 1987, V. 1, P. 533–544
- [2] Borschegovskiy A., Dremin M., Il'in V., Kirneva N., Kislov A., Krupin V., Maltsev S., Pavlov Y., Petrov D., Roy I., Shelukhin D., Sokolov M., «Optimization of ECR-breakdown and plasma discharge formation on T-10 tokamak, using X-mode second harmonic of ECR» // EPJ Web of Conferences 32, 020, 2012.
- [3] Shestakov E.A., Savrukhin P.V., Lisovoy P.D. et al., "Diagnostics of superheated and hard X-ray radiation on tokamak T-15MD" // DVP 2023, Abstracts, P.129–131 (in Russian).

^{*)} [abstracts of this report in Russian](#)